

**SUMMARY OF  
THE DELAWARE 1999 RATE-OF-PROGRESS PLAN  
FOR KENT AND NEW CASTLE COUNTIES**

**for Demonstrating Progress Toward Attainment  
of the National Ambient Air Quality Standard  
for Ozone**

**Submitted By:  
The Delaware Department of Natural Resources  
and Environmental Control  
in Conjunction with  
The Delaware Department of Transportation**

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# INTRODUCTION

## BACKGROUND

This document is a summary of Delaware's 1999 Rate-of-Progress Plan (RPP) which addresses Delaware's nonattainment of the National Ambient Air Quality Standard (NAAQS) for ozone, as required by the Clean Air Act Amendments of 1990 (CAAA).<sup>1</sup> Section 182(d) of the CAAA requires states to submit a plan to the United States Environmental Protection Agency (EPA), for each ozone nonattainment area classified as severe or above, that achieves a 15 percent net reduction by November 15, 1996, of actual anthropogenic Volatile Organic Compound (VOC) emissions. The SIP revision for 1990-1996 reductions is widely known as the "15 Percent Rate-of-Progress Plan (RPP)". Delaware submitted its 15 Percent Rate-of-Progress Plan to the EPA in February 1995. In addition to the 15 percent reduction, Section 182(d) of the CAAA requires states to submit a plan that achieves an actual VOC emission reduction of at least 3 percent per year averaged over each consecutive 3-year period beginning November 15, 1996, until the area's applicable attainment date. The attainment date for the Kent and New Castle County severe ozone nonattainment area is November 15, 2005. A March 2, 1995 memorandum from Ms. Mary D. Nichols, EPA's Regional Administrator, provides for states within the Ozone Transport Region (OTR) with serious and above ozone nonattainment areas a two-phased approach to the post-1996 rate of progress and attainment plan.<sup>2</sup> Under the first phase, States are required to submit a plan with a set of specific control measures to show at least a 9 percent net reduction of VOC and/or NO<sub>x</sub> emissions between 1996 and 1999 to satisfy the rate of progress requirements. In addition, the SIP revision should include modeling results with interim assumptions about ozone transport. The second phase is a 2-year process that assesses regional and local control strategies to show attainment and resolve transport issues of ozone and ozone precursors. The Delaware 1999 Rate-of-Progress Plan satisfies the rate of progress requirements for Phase I.

The NAAQS are air quality standards for pollutants that pose public health risks. Delaware exceeds the standard for only one of these pollutants, ozone. High levels of ozone can harm the respiratory system and cause breathing problems, throat irritation, coughing, chest pains, and greater susceptibility to respiratory infection. Ozone is generally not directly emitted to the atmosphere, but is formed in the atmosphere by a chemical reaction between volatile organic compounds (VOC), oxides of nitrogen (NO<sub>x</sub>), and carbon monoxide (CO) in the presence of sunlight. Consequently, in order to reduce ozone concentrations, the CAAA requires specific amounts of reductions in anthropogenic VOC emissions and NO<sub>x</sub> emissions over a specified period of years until the ozone standard is met.

The CAAA defines five nonattainment area classifications for areas that exceed the NAAQS, based on the severity of the pollution problem. They are, in order of increasing severity, "marginal", "moderate", "serious", "severe", and "extreme". Attainment dates and plan submission requirements

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<sup>1</sup>Federal Clean Air Act, 42 U.S.C.A. §7401 *et seq.*, as amended by the Clean Air Act Amendments of 1990, P.L. 101-549, November 15, 1990

<sup>2</sup>Ozone Attainment Demonstrations, Mary D. Nichols, Assistant Administrator for Air and Radiation, U.S. EPA, Washington, D.C. 20460, March 02, 1995

depend on the classification for each area.<sup>3</sup> As shown in Figure 1, Kent and New Castle Counties fall within the Philadelphia Consolidated Metropolitan Statistical Area (CMSA), which is classified as a severe nonattainment area for ozone. Kent and New Castle are the two counties for which Delaware is required to develop a Post-1996 RPP. All discussions and data presented in this summary apply only to Kent and New Castle Counties.

The 3 percent per year emissions reduction requirement is based on the 1990 Base Year Ozone SIP Emission Inventory which is an inventory of 1990 actual VOC, NO<sub>x</sub>, and CO emissions from sources in Delaware. The amount of VOC emissions reduction that the State must achieve to meet the 3 percent per year emissions reduction requirement is determined from 1990 Base Year emissions levels after accounting for any growth in emissions between the base year (1990) and the milestone year 1999. In effect, the State must plan to implement control measures that will not only reduce 1990 emissions levels at least by an average of 3 percent per year for the 1996-1999 period, but also offset emissions that will be produced as a result of economic growth. The plan must show that expected emissions reductions from federal and State control measures are enough to meet the required 3 percent per year emissions reduction net of growth.

## **RESPONSIBILITIES**

The agency with direct responsibility for preparing and submitting the 1999 Rate-of-Progress Plan is the Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Air and Waste Management, Air Quality Management Section (AQM), under the direction of Darryl D. Tyler, Program Administrator. The Delaware Department of Transportation (DelDOT) in conjunction with Vanasse Hangen Brustlin, Inc. is responsible for performing the work associated with the on-road mobile source portions of this plan. Various other State agencies, including the Department of Labor, the Department of Public Safety, and the Department of Agriculture provided information for use in developing the plan.

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<sup>3</sup>CAAA, Title I, Part D, Sec. 181

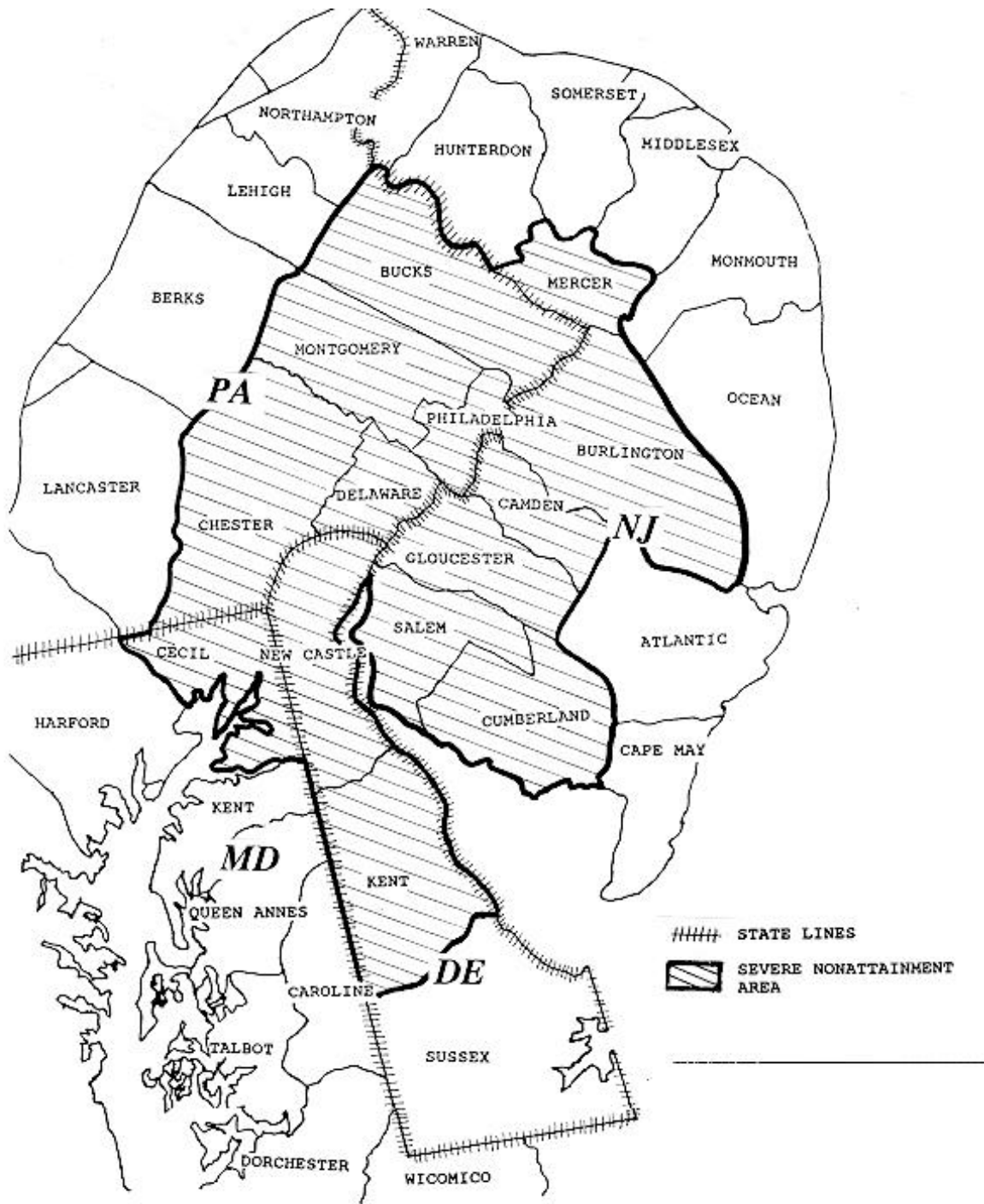


Figure 1. Philadelphia CMSA Nonattainment Area

## **PART I**

### **THE 1990 BASE YEAR INVENTORY SUMMARY AND 1999 TARGET LEVEL OF VOC AND NO<sub>x</sub> EMISSIONS**

#### **THE 1990 BASE YEAR INVENTORY SUMMARY**

The nonattainment plan provisions in the CAAA require states in nonattainment areas to submit to the EPA an initial inventory of actual emissions from all sources of relevant pollutants.<sup>4</sup> This inventory is to be used as the basis for determining required emissions reductions. Calendar year 1990 is the time frame for this first emissions inventory, which is called the 1990 Base Year Ozone State Implementation Plan (SIP) Emissions Inventory (hereafter referred to as the 1990 Base Year Inventory). Delaware's final 1990 Base Year Inventory was submitted to the EPA as a SIP revision on May 27, 1994, and approved by EPA on March 25, 1996.

The 1990 Base Year Inventory is categorized into point, stationary area, off-road mobile, on-road mobile, and biogenic sources of emissions. Volatile organic compounds (VOC), nitrogen oxides (NO<sub>x</sub>), and carbon monoxide (CO) are the ozone precursor emissions reported for each category in the 1990 Base Year Inventory. Because CO is only marginally reactive in producing ozone, the CO component of the 1990 Base Year Inventory does not figure into the rate of progress requirements. Therefore, only the VOC and NO<sub>x</sub> components of the 1990 Base Year Inventory are summarized here. The results of Delaware's 1990 Base Year Inventory are summarized in Table 1 for VOC and NO<sub>x</sub> emissions from Kent and New Castle Counties. The values in Table 1 are reported in tons per peak ozone season day. The peak ozone season for Delaware is defined as June 1 through August 31.

The percent VOC contribution of each source component listed in Table 1 to the total VOC emissions from Kent and New Castle Counties is shown in Figure 2. These relative proportions are shown both for the total inventory of all sources, and for the anthropogenic inventory which excludes biogenic emissions. In order to produce the 1999 Rate-of-Progress Plan, adjustments must be made to the 1990 Base Year Inventory following EPA guidelines, and the 1999 target level of emissions must be calculated from that Adjusted Base Year Inventory. The anthropogenic inventory is the inventory from which the Adjusted Base Year Inventory is calculated.

The percent NO<sub>x</sub> contribution of each source component listed in Table 1 to the total NO<sub>x</sub> emissions from Kent and New Castle Counties is shown in Figure 3. All NO<sub>x</sub> emissions in the 1990 Base Year Inventory are from anthropogenic sources. NO<sub>x</sub> emissions from biogenic sources are considered to be negligible and are not included in the 1990 Base Year Inventory.

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<sup>4</sup>CAAA, Title I, Part D, Sec. 172(c)(3) and Sec. 182

**TABLE 1**  
**1990 BASE YEAR INVENTORY SUMMARY OF VOC AND NO<sub>x</sub> EMISSIONS**  
**IN TONS PER PEAK OZONE SEASON DAY**

SOURCE CATEGORY	KENT COUNTY		NEW CASTLE COUNTY		TOTAL NONATTAINMENT AREA	
	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>
Point Sources	3.242	6.130	27.078	85.767	30.320	91.897
Stationary Area Sources	12.967	1.202	34.754	5.398	47.721	6.600
Off-Road Mobile Sources	3.494	7.891	16.674	18.777	20.168	26.668
On-Road Mobile Sources	13.070	10.620	35.280	27.060	48.350	37.680
Biogenic Sources	32.460	0.000	17.510	0.000	49.970	0.000
<b>Total Emissions</b>	<b>65.233</b>	<b>25.843</b>	<b>131.296</b>	<b>137.002</b>	<b>196.529</b>	<b>162.845</b>

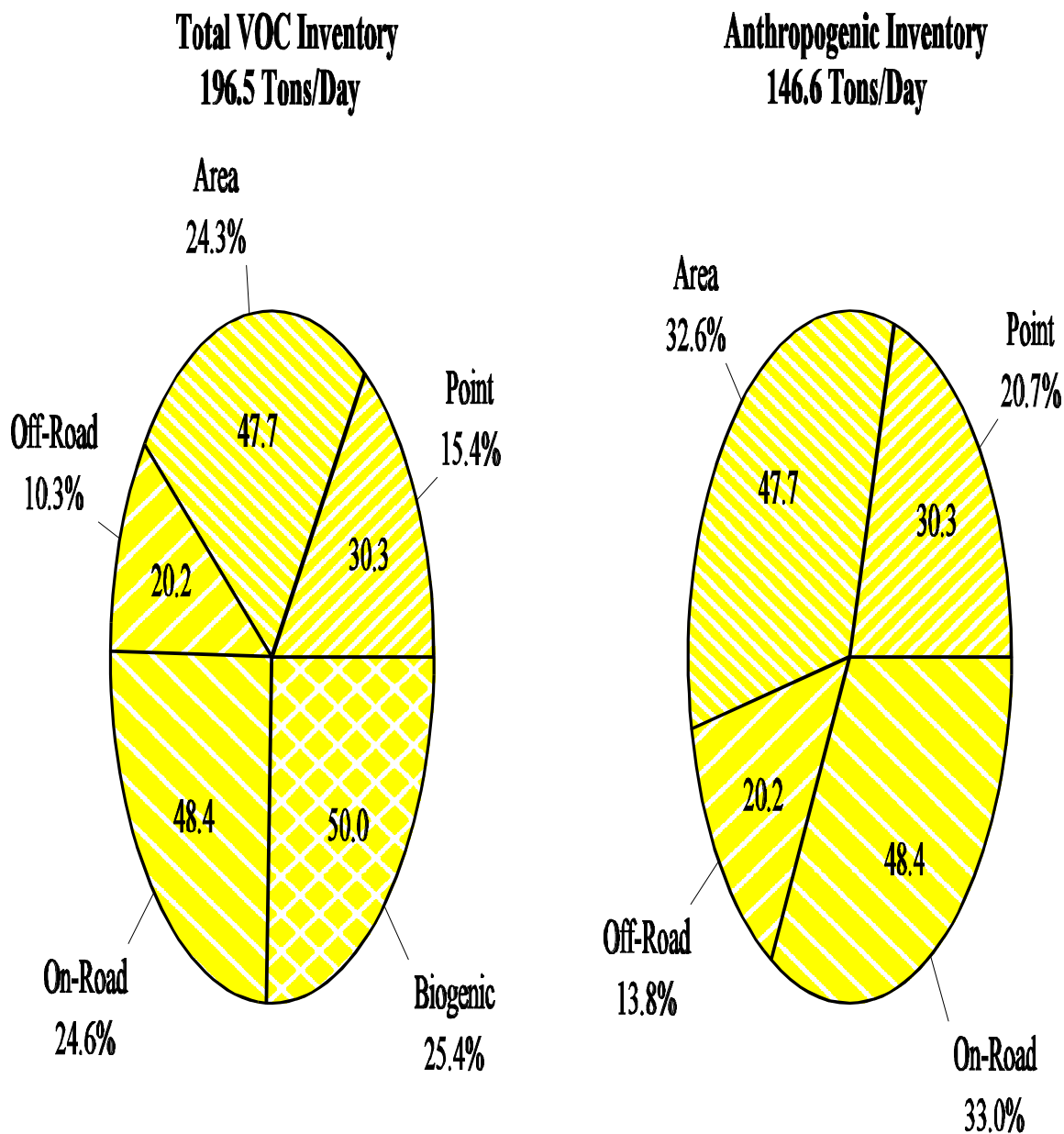


Figure 2. Contribution of Source Components to Total 1990 Base Year VOC Emissions in the Severe Nonattainment Area (Kent and New Castle Counties Only)

**Total NO<sub>x</sub> Inventory  
162.8 Tons/Day**

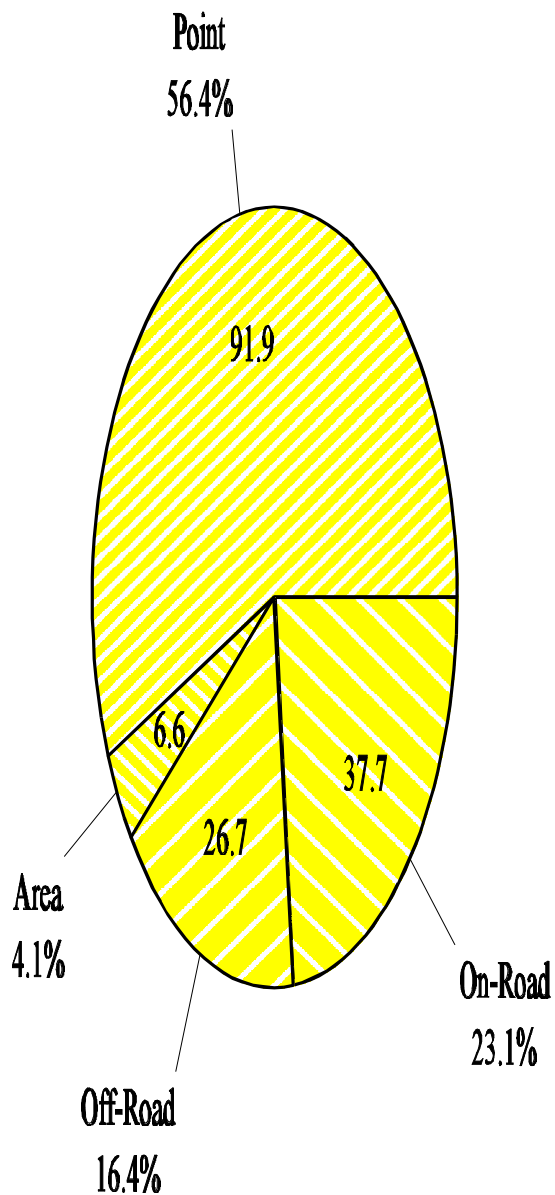


Figure 3. Contribution of Source Components to Total 1990 Base Year NO<sub>x</sub> Emissions in the Severe Nonattainment Area (Kent and New Castle Counties Only)

## THE 1999 TARGET LEVEL OF VOC EMISSIONS WITHOUT NO<sub>x</sub> SUBSTITUTION

The 1999 Target Level of VOC emissions is the maximum amount of anthropogenic VOC emissions allowed in 1999 under the rate of progress requirement. However, Section 182(c)(2)(C) of the CAAA allows states to substitute actual NO<sub>x</sub> emissions reductions occurring after 1990 to meet the post-1996 VOC emissions reduction requirements. Such a substitution is permitted provided the emissions reduction meets the criteria outlined in the EPA's December 15, 1993, *NO<sub>x</sub> Substitution Guidance*<sup>5</sup>. The condition for meeting the rate of progress requirement is that the sum of all creditable VOC and NO<sub>x</sub> emissions reductions must be equal to 3 percent per year averaged over the applicable 3-year period.

In addition, the overall VOC and NO<sub>x</sub> emissions reductions must be consistent with the area's modeled attainment demonstration. However, the EPA issued policy memorandum *Clarification of Policy for Nitrogen Oxides (NO<sub>x</sub>) Substitution*<sup>6</sup>, dated July 12, 1994, modifies the consistency requirement. The new policy requires that the State must have adopted NO<sub>x</sub> RACT regulations and completed at least one Urban Airshed Modeling (UAM) or Regional Oxidant Modeling (ROM) analysis supporting the use of NO<sub>x</sub> controls to reduce ozone in the area under consideration. The State of Delaware has satisfied these two requirements. The Department adopted NO<sub>x</sub> RACT regulations on November 24, 1993, and these regulations went into effect from May 31, 1995. A preliminary analysis of UAM for the Philadelphia-New Jersey UAM Airshed has demonstrated that as much as 75% of VOC and 75% of NO<sub>x</sub> controls could be necessary to achieve the ozone NAAQS standard. Therefore, NO<sub>x</sub> control is critical for Delaware's severe nonattainment area to reach attainment of the ozone standard.

This section presents the method of calculating the target level of VOC emissions for the milestone year 1999 without NO<sub>x</sub> substitution as outlined in the *Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration*, Ozone/Carbon Monoxide Programs Branch, U.S. Environmental Protection Agency, Office of Planning and Standards, Research Triangle Park, NC 27711, February 18, 1994 (hereafter referred to as the *Guidance on the Post-1996 Rate-of-Progress Plan*). Then the 1999 VOC target levels will be compared to the expected level of VOC emissions for the milestone year 1999 which is the result of applying all expected national, regional and State control measures. If this comparison demonstrates that the expected VOC emissions level for the milestone year 1999 does not meet the target level, then the NO<sub>x</sub> substitution will be made.

The target level of VOC emissions for the 1999 milestone year represents the maximum amount of anthropogenic VOC emissions that the nonattainment area can emit in 1999 while complying with the post-1996 rate of progress requirements. The *Guidance on the Post-1996 Rate-of-Progress Plan* gives the target level of any milestone year  $x$  as:

$$TL_x = TL_y - BG_r - FT_x$$

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<sup>5</sup>*NO<sub>x</sub> Substitution Guidance*, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, December, 1993.

<sup>6</sup>*Clarification of Policy for Nitrogen Oxides (NO<sub>x</sub>) Substitution*, from John Seitz, Director, Office of Air Quality Planning and Standards, July 12, 1994.

where:

$x$	=	current milestone year
$y$	=	previous milestone year
$TL_x$	=	target level of emissions for year $x$
$TL_y$	=	target level of emissions for year $y$
$BG_r$	=	Emission reduction requirement for year $x$
$FT_x$	=	Fleet turnover correction term for year $x$

That is, the target level of emissions for the milestone year  $x$  is calculated by subtracting the 3 percent per year rate of progress emission reduction requirement and the fleet turnover correction from the previous milestone's target level. There are six major steps involved in calculating the 1999 target level of VOC emissions. The first four steps are needed to calculate the 3 percent per year rate of progress emissions reductions.

### **Step 1 - Development of the 1990 Base Year Inventory**

The 1990 base year inventory serves as the starting point for all other inventories. A breakout by source category of the 1990 base year inventory of VOC and NO<sub>x</sub> emissions is presented in Table 1.

### **Step 2 - Development of the 1990 Rate-of-Progress or Baseline Inventory**

This inventory forms the "baseline" from which to calculate the 9 percent emissions reduction for the 1996-1999 period. The 1990 baseline inventory accounts for all anthropogenic emissions in the Delaware's severe nonattainment area. Therefore, this emissions inventory is calculated by removing biogenic emissions and any emissions from the sources located outside of the nonattainment area from the base year inventory. In addition, perchloroethylene (PERC) emissions are subtracted from the 1990 Base Year Inventory. PERC emissions were originally classified by the EPA as a photochemically reactive VOC for emission inventory purposes. The EPA reclassified PERC as photochemically *non-reactive* after the 1990 Base Year Inventory was compiled. Because only the photochemically *reactive* VOCs participate in the formation of ozone, the PERC emissions, are subtracted from the 1990 Base Year Inventory prior to the target level calculations. A breakout by source category of the 1990 baseline inventory of VOC emissions is presented in Table 2.

### **Step 3 - Development of the 1990 Adjusted Base Year Inventory**

Section 182(b)(1)(D) requires the removal of emissions reductions that will occur by the milestone year due to the Federal Motor Vehicle Control Program (FMVCP) and Reid Vapor Pressure (RVP) regulations promulgated prior to 1990. Therefore, the 1990 baseline inventory is adjusted by subtracting the VOC emissions reductions that are expected to occur between 1990 and the target milestone year as a result of the FMVCP and RVP regulations. The result of this step is called the 1990 Adjusted Base Year Inventory.

The FMVCP and RVP VOC emissions reductions that are expected to occur between 1990 and milestone year 1999 are determined using the on-road mobile source emissions modeling software, MOBILE5a, provided by the EPA. The MOBILE5a input and output files for the 1990 Adjusted Base Year Inventory for the target year 1999 are provided by the Delaware Department of Transportation (DelDOT) through their contractor Vanasse Hangen Brustlin,

Inc. (VHB). The VOC emissions reductions that will occur between 1990 and the milestone year 1999 as a result of the FMVCP and RVP regulations are determined by subtracting the 1990 Adjusted Base Year Inventory of on-road mobile source emissions relative to each milestone from the 1990 Baseline Inventory of on-road mobile source emissions. This operation is shown in Table 3.

**TABLE 2**  
**1990 BASELINE INVENTORY SUMMARY OF VOC AND NO<sub>x</sub> EMISSIONS**  
**IN TONS PER PEAK OZONE SEASON DAY**

SOURCE CATEGORY	KENT COUNTY		NEW CASTLE COUNTY		TOTAL NONATTAINMENT AREA	
	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>
Point Sources	3.242	6.130	26.938	85.767	30.180	91.897
Stationary Area Sources	12.779	1.202	34.366	5.398	47.145	6.600
Off-Road Mobile Sources	3.494	7.891	16.674	18.777	20.168	26.668
On-Road Mobile Sources	13.070	10.620	35.280	27.060	48.350	37.680
<b>Total Emissions</b>	<b>32.585</b>	<b>25.843</b>	<b>113.258</b>	<b>137.002</b>	<b>145.843</b>	<b>162.845</b>

**TABLE 3**  
**NON-CREDITABLE FMVCP/RVP VOC AND NO<sub>x</sub> EMISSIONS REDUCTIONS**  
**IN TONS PER PEAK OZONE SEASON DAY**

DESCRIPTION	VOC	NO <sub>x</sub>	
1990 Base Year On-Road Mobile Source Emissions	48.350	37.680	(a)
1990 Adjusted Base Year On-Road Mobile Inventory Relative to 1996	38.760	34.700	(b)
1990 Adjusted Base Year On-Road Mobile Inventory Relative to 1999	36.850	33.730	(c)
<b>FMVCP/RVP Emissions Reductions for 1990-1999</b>	<b>11.500</b>	<b>3.950</b>	<b>(d)=(a)-(c)</b>
<b>Fleet Turnover Correction for 1996-99</b>	<b>1.910</b>	<b>0.970</b>	<b>(e)=(b)-(c)</b>

#### **1990 Adjusted Base Year Inventory Calculation**

The total 1990 Adjusted Base Year Inventory relative to a milestone year is obtained by subtracting the non-creditable FMVCP/RVP emissions reductions from the 1990 Baseline Inventory. This operation is shown in Table 4.

#### **Step 4 - Calculation of Required 3 Percent per Year VOC Reductions**

The required average 3 percent per year VOC emissions reduction for the 1996-1999 period is determined by multiplying the 1990 Adjusted Base Year Inventory determined in step 3 by 9 percent (0.09). The reductions are:

Required 9 Percent VOC Reductions for 1996-99 period =  $134.343 \times 0.09$   
= 12.091 tons VOC/day

**TABLE 4**  
**ADJUSTED 1990 VOC AND NO<sub>x</sub> EMISSIONS INVENTORY RELATIVE TO**  
**MILESTONE YEAR 1999 IN TONS PER PEAK OZONE SEASON DAY**

DESCRIPTION	VOC	NO <sub>x</sub>	
1990 Baseline Inventory from Step 2	145.843	162.845	(f)
FMVCP/RVP Emissions Reductions between 1990 and Post-1996 Milestone Year	11.500	3.950	(g)
<b>1990 Adjusted Base Year Inventory Relative to Milestone Year 1999</b>	<b>134.343</b>	<b>158.895</b>	<b>(h)=(f)-(g)</b>

#### Step 5 - Calculation of Fleet Turnover Correction Term

In the absence of any new requirements of the CAAA, there would still be some decrease in motor vehicle emission factors for many years as a result of fleet turnover, the gradual replacement of older pre-control vehicles with newer vehicles with controls. The CAAA does not allow States to take credit for these reductions for rate of progress purposes. The emissions reductions due to any fleet turnover during the consecutive milestone years are not creditable, and therefore, need to be accounted in figuring the target level of emissions for a milestone year. Hence, the 1999 target level of VOC emissions is estimated from the 1996 VOC target level, which does not account for fleet turnover correction for the 1996-1999 period. Therefore, the 1999 target level is obtained by subtracting the 9 percent reduction and the fleet turnover correction from the previous target level. The fleet turnover correction for the 1999 target level is obtained by subtracting the adjusted mobile source emissions of 1999 from the adjusted mobile source emissions of 1996. This operation is shown in Table 3.

#### Step 6 - Calculation of the 1999 Target Level of VOC Emissions

The 1999 target level of VOC emissions is determined by subtracting the 9 percent emissions reductions calculated in step 4 and the fleet turnover correction term in step 5 from the 1996 VOC target level. This operation is indicated in Table 5.

**TABLE 5**  
**1999 TARGET LEVEL OF VOC EMISSIONS WITHOUT NO<sub>x</sub> SUBSTITUTION**  
**IN TONS PER PEAK OZONE SEASON DAY**

DESCRIPTION	VOCs	
Target Level for 15% Plan	115.815	(i)
9% Required Reductions	12.091	(j)
Fleet Turnover Correction	1.910	(k)
<b>VOC Target Level for Milestone Year 1999</b>	<b>101.814</b>	<b>(l)=(i)-(j)-(k)</b>

## **Comparison of the 1999 VOC Target Level with the Expected 1999 VOC Level**

In order to meet the 3 percent per year rate of progress requirement, Delaware's 1999 anthropogenic VOC emissions in Kent and New Castle Counties must not exceed the target levels indicated in Table 5. The expected VOC emissions for the milestone year 1999 with all possible known national, regional and local control measures are estimated and listed Table 14. These are the maximum achievable emissions considering all feasible VOC control measures contained in the 15% plan and any new national, regional and local VOC control measures that will be implemented after 1996. When the 1999 expected VOC emissions level of 110.185 tons VOC/day is compared to the 1999 target level of 101.814 tons VOC/day, it is observed that Kent and New Castle Counties do not meet the 1999 target level. Therefore, it has become clear that NO<sub>x</sub> substitution is necessary to meet the 1999 rate of progress requirement.

## **THE 1999 TARGET LEVEL OF VOC EMISSIONS WITH NO<sub>x</sub> SUBSTITUTION**

Section 182(c)(2)(C) of the CAAA states that the actual NO<sub>x</sub> emissions reductions occurring after 1990 can be used to meet the post-1996 emissions reduction requirement, provided that such reductions meet the criteria outlined in the EPA's December 15, 1993 *NO<sub>x</sub> Substitution Guidance*. The conditions set forth in the *NO<sub>x</sub> Substitution Guidance* are:

- the sum of all creditable VOC and NO<sub>x</sub> emission reductions must equal 3 percent per year averaged over each applicable milestone period,
- the overall VOC and NO<sub>x</sub> emission reductions must be consistent with the area's modeled attainment demonstration.

The second condition, i.e. the consistency requirement, is modified by the EPA issued policy memorandum *Clarification of Policy for Nitrogen Oxides (NO<sub>x</sub>) Substitution*, dated July 12, 1994. The new policy requires that the State must have adopted NO<sub>x</sub> RACT regulations and demonstrate, through modeling of at least one episode with photochemical modeling or ROM analysis, the usefulness of NO<sub>x</sub> controls in reducing the ozone concentrations. The State of Delaware satisfies these two requirements. The Department has adopted NO<sub>x</sub> RACT regulations on November 24, 1993 and these regulations went into effect from May 31, 1995. The UAM sensitivity analysis for the Philadelphia-New Jersey UAM Airshed has demonstrated that as much as 75 percent of VOC and 75 percent of NO<sub>x</sub> controls could be necessary to achieve the ozone standard in that domain. Therefore, Delaware meets the consistency requirement for NO<sub>x</sub> substitution.

## **Calculation of the 1999 VOC and NO<sub>x</sub> Target Levels**

The 1999 VOC and NO<sub>x</sub> target levels of emissions represent the maximum amounts of VOC and NO<sub>x</sub> emissions permitted for the milestone year 1999 satisfying the 3 percent per year rate of progress requirement. The steps required for determining the target levels are similar to those required without NO<sub>x</sub> substitution. The 1999 milestone NO<sub>x</sub> target level, however, is calculated differently since there is not a 1996 NO<sub>x</sub> target that can be used to calculate the 1999 target. There are six major steps in calculating the 1999 VOC and NO<sub>x</sub> target levels of emissions:

### **Step 1- Development of the 1990 Base Year Inventory**

The 1990 base inventory serves as the starting point for all other inventories. A breakout by source category of the 1990 base year inventory of VOC and NO<sub>x</sub> emissions is presented in Table 1.

### **Step 2 - Development of the 1990 Rate-of-Progress or Baseline Inventory**

This inventory forms the "baseline" from which to calculate the 9 percent emissions reduction for the 1996-1999 period, and accounts for all anthropogenic emissions in Delaware's severe nonattainment area. It is calculated by removing biogenic emissions and any emissions from the sources located outside of the nonattainment area from the base year inventory. A breakout by source category of the 1990 baseline inventory of VOC and NO<sub>x</sub> emissions is presented in Table 2.

### **Step 3 - Development of the 1990 Adjusted Base Year Inventory**

Section 182(b)(1)(D) requires the removal of emissions reductions that will occur by the milestone year due to FMVCP and RVP regulations promulgated prior to 1990. Therefore, the 1990 baseline inventory excludes VOC and NO<sub>x</sub> emissions that would be eliminated by FMVCP and RVP regulations prior to the enactment of CAAA. The result of this step is the 1990 Adjusted Base Year Inventory.

The FMVCP and RVP NO<sub>x</sub> emissions reductions that are expected to occur between 1990 and 1999 are determined using the on-road mobile source emissions modeling software, MOBILE5a, provided by the EPA. The MOBILE5a input and output files for the 1990 Adjusted Base Year Inventory were provided by the Delaware Department of Transportation (DelDOT) through their contractor Vanasse Hangen Brustlin, Inc. (VHB). The NO<sub>x</sub> emissions reductions that will occur between 1990 and 1999 as a result of the FMVCP and RVP regulations are determined by subtracting the 1990 Adjusted Base Year Inventory of On-Road Mobile Source Emissions from the 1990 Baseline Inventory of On-Road Mobile Source Emissions. The results are presented in Table 4.

### **Step 4 - Calculation of Required Creditable Reductions**

The percent reduction required for VOC and NO<sub>x</sub> emissions is calculated separately. The sum of all creditable VOC and NO<sub>x</sub> emissions reductions must equal the average 3 percent per year required reductions. The VOC emissions reduction that can be applied for the rate of progress of milestone year 1999 is obtained by subtracting the sum of non-creditable fleet turnover correction term and the expected VOC emissions level in the milestone year from the previous milestone year target level of VOC emissions. The results are summarized in Table 6.

The percent of VOC reduction creditable toward the 3 percent per year rate of progress is determined from the 1990 Adjusted Base Year Inventory of VOC Emissions. The creditable VOC emissions reduction obtained for milestone year 1999 (Table 6) is converted to equivalent percentages, and is found to be 2.770%. The percent NO<sub>x</sub> reduction that can be

substituted to meet the average 3 percent per year rate of progress is obtained from the fact that the sum of all creditable VOC and NO<sub>x</sub> emissions reduction must equal 9 percent between successive milestone years. The percent of VOC and NO<sub>x</sub> emissions reductions required to meet the 3 percent per year rate of progress requirement are indicated in Table 7.

**TABLE 6**  
**VOC EMISSIONS REDUCTIONS CREDITABLE FOR THE 3 PERCENT PER YEAR**  
**RATE OF PROGRESS REQUIREMENT IN TONS PER PEAK OZONE SEASON DAY**

DESCRIPTION	VOCs	
VOC Target Level for Previous Milestone	115.815	(m)
VOC Fleet Turnover for Applicable Period	1.910	(n)
VOC Control Strategy Projections of Milestone Year 1999	110.185	(o)
<b>VOC reduction creditable for 3% per year rate of progress</b>	<b>3.720</b>	<b>(p)=(m)-(n)-(o)</b>

**TABLE 7**  
**PERCENT OF VOC AND NO<sub>x</sub> EMISSION REDUCTIONS NEEDED**  
**FOR THE 3-PERCENT PER YEAR RATE OF PROGRESS REQUIREMENT**

MILESTONE YEAR	VOC REDUCTION (%)	NO <sub>x</sub> REDUCTION (%)	TOTAL (%)
1999	2.770	6.230	9

The amount of NO<sub>x</sub> emissions reduction in tons per day that can be substituted for VOC reductions is obtained by multiplying the percent NO<sub>x</sub> emissions reductions obtained in Table 7 with the appropriate 1990 Adjusted Base Year Inventory of NO<sub>x</sub> emissions. The VOC and NO<sub>x</sub> emissions reductions in tons per day required to meet the average 3 percent per year rate of progress are summarized in Table 8.

**TABLE 8**  
**VOC AND NO<sub>x</sub> EMISSION REDUCTIONS NEEDED**  
**FOR THE 3-PERCENT PER YEAR RATE OF PROGRESS REQUIREMENT**  
**IN TONS PER PEAK OZONE SEASON DAY**

MILESTONE YEAR	VOC REDUCTION	NO <sub>x</sub> REDUCTION
1999	3.720	9.900

### Step 5 - Calculation of Fleet Turnover Correction Term

The fleet turnover correction is the difference between the FMVCP/RVP emissions reductions calculated in step 3 and the previous milestone year's FMVCP/RVP emissions reductions. However for the milestone year 1999, this term is not calculated for NO<sub>x</sub> emissions. Unlike the VOC target level, the NO<sub>x</sub> target level is determined differently because there is no 1996 NO<sub>x</sub> target level. The 1999 NO<sub>x</sub> target level is calculated by adjusting the 1990 baseline as described in Step 6. Therefore, the estimation of fleet turnover correction for 1999 NO<sub>x</sub> target level is not required. The non-creditable fleet turnover corrections for the milestone year 1999 are indicated in Table 3.

### Step 6 - Calculation of the 1999 Target Level of VOC and NO<sub>x</sub> Emissions

The 1999 VOC and NO<sub>x</sub> target levels are calculated by subtracting the required emissions reductions calculated in step 4 and the fleet turnover correction term estimated in step 5 from the previous target level. As mentioned above, the 1999 NO<sub>x</sub> target is calculated by subtracting the emissions reductions calculated in step 4 and the non-creditable FMVCP/RVP emissions reductions calculated in step 3 from the 1990 baseline. The 1999 target level of VOC and NO<sub>x</sub> emissions are summarized in Table 9.

**TABLE 9**  
**THE 1999 TARGET LEVEL OF VOC AND NO<sub>x</sub> EMISSIONS**  
**IN TONS PER PEAK OZONE SEASON DAY**

DESCRIPTION	VOC	NO <sub>x</sub>
1996 VOC Target Level/1990 NO <sub>x</sub> Baseline	115.815	162.845
VOC/NO <sub>x</sub> Fleet turnover	1.910	N/A
NO <sub>x</sub> FMVCP/RVP during 1990-1999	N/A	3.950
Emission Reduction Requirement	3.720	9.900
<b>1999 Target Levels</b>	<b>110.185</b>	<b>148.995</b>

In order to meet the average 3 percent per year rate of progress requirement for the milestone year 1999, the anthropogenic VOC and NO<sub>x</sub> emissions in Kent and New Castle Counties must not exceed the target levels shown in Table 9.

## PART II

### THE 1999 GROWTH FACTORS AND THE 1999 CURRENT CONTROL PROJECTION INVENTORY

#### THE 1999 CURRENT CONTROL PROJECTION INVENTORY

In order to determine the total amount of VOC and NO<sub>x</sub> emissions reductions for the 1996-1999 period, the emissions levels for the milestone year 1999 must be estimated. For this purpose, the 1999 growth factors are developed for various source categories of emissions based on economic indicators. The 1990 baseline emissions are multiplied by these growth factors, and the resulting inventory is called the 1999 Current Control Projection Inventory. **The 1999 Current Control Projection Inventory is an estimation of the amount of VOC/NO<sub>x</sub> emissions that will occur in 1999, if no new emission control measures are implemented between 1990 and 1999.** The difference between the 1999 Current Control Projection Inventory and the 1999 Target Level of Emissions is the total amount of emissions that the State must plan to reduce in order to meet the 3 percent per year VOC reduction requirement for the 1999 target year. This section contains a discussion of how the total VOC and NO<sub>x</sub> emissions reduction requirement is determined.

The 1999 Current Control Projection Inventory of VOC and NO<sub>x</sub> emissions for the Kent and New Castle Counties is summarized in Table 10. The VOC and NO<sub>x</sub> emissions projections by county are summarized in Tables 11 and 12, respectively. Also included for comparison purposes in these tables are the 1990 Baseline and 1996 Current Control Projection emissions for each category. The 1999 Current Control Projection and Baseline VOC and NO<sub>x</sub> data are shown graphically in Figures 4 and 5, respectively. Figures 6 and 7 show the relative proportions of VOC and NO<sub>x</sub> emissions for each source category in the 1999 Current Control Projection Inventory for the entire severe nonattainment area.

**TABLE 10**  
**SUMMARY OF 1999 CURRENT CONTROL PROJECTION INVENTORY OF VOC**  
**AND NO<sub>x</sub> EMISSIONS FOR THE KENT AND NEW CASTLE COUNTY**  
**NONATTAINMENT AREA IN TONS PER PEAK OZONE SEASON DAY**

CATEGORY	VOC EMISSIONS PROJECTIONS			NO <sub>x</sub> EMISSIONS PROJECTIONS		
	1990	1996	1999	1990	1996	1999
Point Sources	30.180	29.826	30.461	91.897	101.726	103.231
Stationary Area Sources	47.145	48.516	49.955	6.600	6.966	7.204
Off-Road Mobile Source	20.168	20.984	21.622	26.668	27.727	28.474
On-Road Mobile Source	48.350	54.720	57.700	37.680	42.800	45.150
<b>Total Emissions</b>	<b>145.843</b>	<b>154.046</b>	<b>159.738</b>	<b>162.845</b>	<b>179.219</b>	<b>184.059</b>

**TABLE 11**  
**SUMMARY OF 1999 CURRENT CONTROL PROJECTION INVENTORY VOC**  
**EMISSIONS BY COUNTY IN TONS PER PEAK OZONE SEASON DAY**

CATEGORY	KENT COUNTY			NEW CASTLE COUNTY		
	1990	1996	1999	1990	1996	1999
Point Sources	3.242	3.179	3.267	26.938	26.647	27.194
Stationary Area Sources	12.779	13.099	13.473	34.366	35.417	36.482
Off-Road Mobile Sources	3.494	3.788	3.923	16.674	17.196	17.699
On-Road Mobile Sources	13.070	14.660	15.460	35.280	40.060	42.240
<b>Total Emissions</b>	<b>32.585</b>	<b>34.726</b>	<b>36.123</b>	<b>113.258</b>	<b>119.320</b>	<b>123.615</b>

**TABLE 12**  
**SUMMARY OF 1999 CURRENT CONTROL PROJECTION INVENTORY NO<sub>x</sub>**  
**EMISSIONS BY COUNTY IN TONS PER PEAK OZONE SEASON DAY**

CATEGORY	KENT COUNTY			NEW CASTLE COUNTY		
	1990	1996	1999	1990	1996	1999
Point Sources	6.130	6.269	6.538	85.767	95.457	96.693
Stationary Area Sources	1.202	1.269	1.311	5.398	5.697	5.893
Off-Road Mobile Sources	7.891	8.298	8.555	18.777	19.429	19.919
On-Road Mobile Sources	10.620	11.920	12.570	27.060	30.880	32.580
<b>Total Emissions</b>	<b>25.843</b>	<b>27.756</b>	<b>28.974</b>	<b>137.002</b>	<b>151.463</b>	<b>155.085</b>

The point, stationary area, and off-road mobile source portions of the 1999 Current Control Projection Inventory are essentially created by multiplying 1990 Baseline Inventory emissions values by the appropriate growth factors. The on-road mobile source emissions are projected by multiplying emission factors generated using the MOBILE5a software by the projected vehicle miles traveled (VMT) for each of the 1999 milestone years. The remainder of this section is broken down into discussions of the development of growth factors; the methods used to project emissions from the point, stationary area, off-road mobile, and on-road mobile source categories; and the calculation of the required VOC and NO<sub>x</sub> reductions.

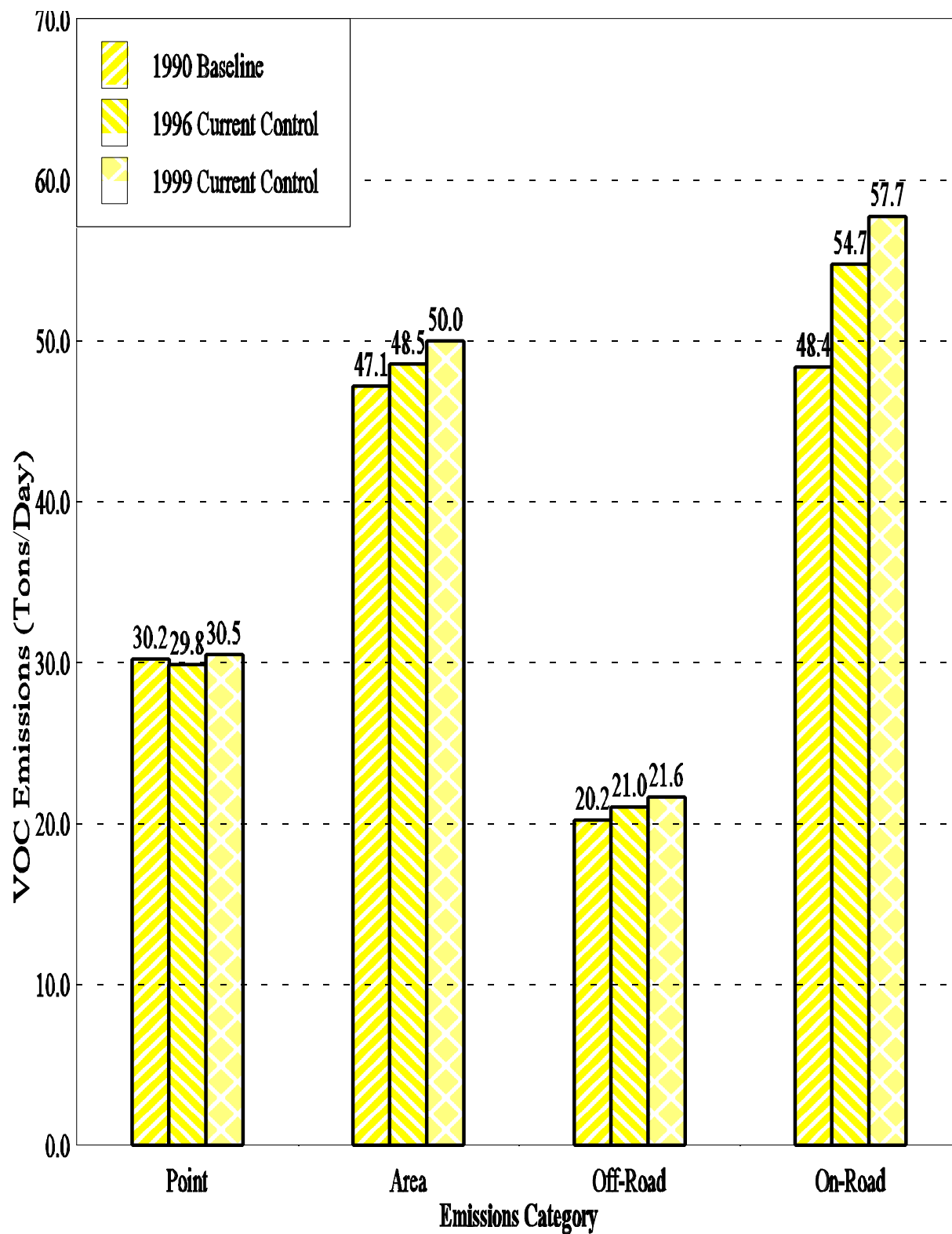


Figure 4. Comparison of 1996 and 1999 Current Control Projection VOC Inventories with the 1990 Baseline VOC Emissions Inventory for the Kent and New Castle County Nonattainment Area

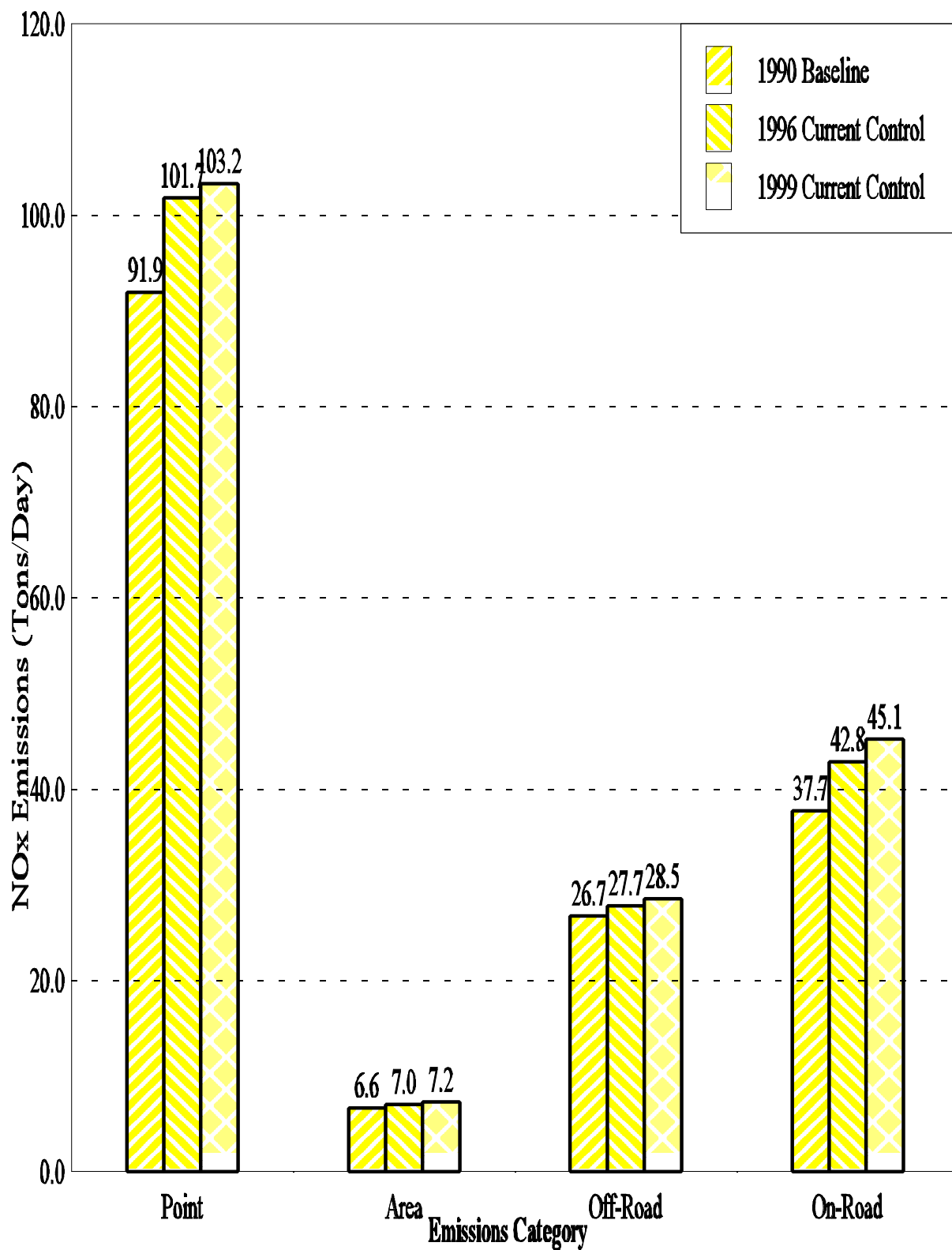


Figure 5. Comparison of 1996 and 1999 Current Control Projection NOx Inventories with the 1990 Baseline NOx Emissions Inventory for the Kent and New Castle County Nonattainment Area

**1999 CURRENT CONTROL PROJECTION OF VOC EMISSIONS**  
**159.7 Tons/Day**

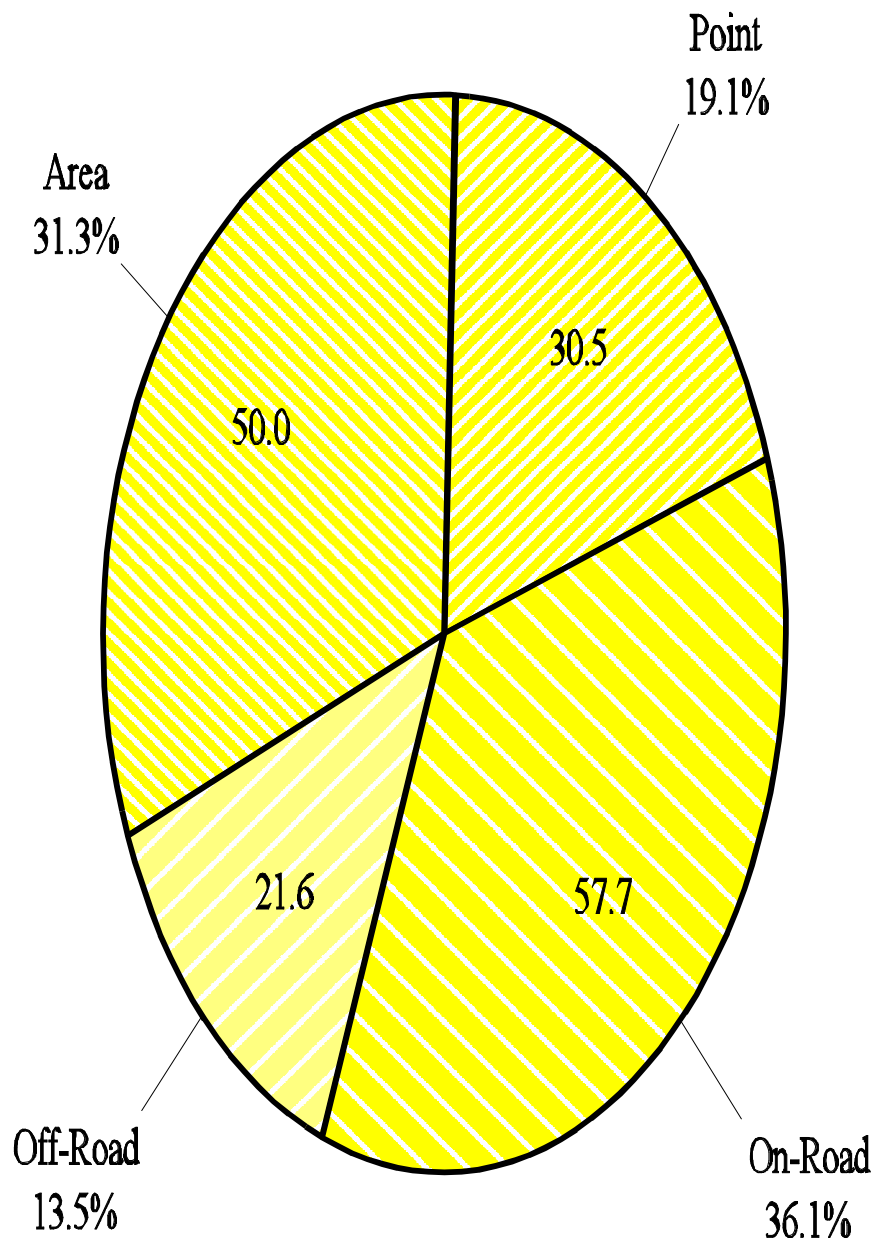


Figure 6. Current Control Projection Inventory of VOC Emissions for the Kent and New Castle County Nonattainment Area by Source Category and County

# 1999 CURRENT CONTROL PROEJCTION OF NO<sub>x</sub> EMISSIONS

184.1 Tons/Day

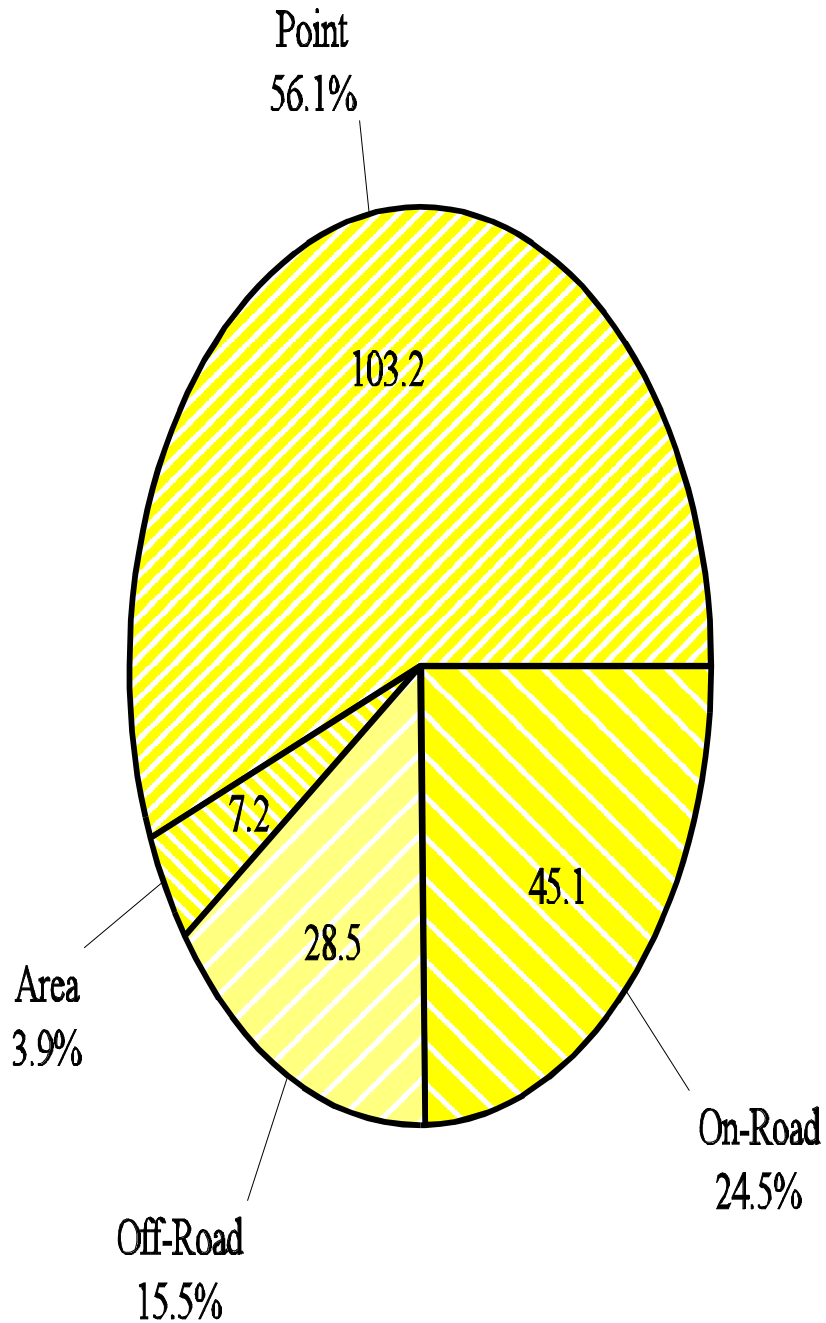


Figure 7. Current Control Projection Inventory of NO<sub>x</sub> Emissions for the Kent and New Castle County Nonattainment Area by Source Category and County

## GROWTH FACTORS

The first step in calculating the 1999 Current Control Projection Inventory is to develop growth factors for all source categories of VOC emissions except on-road mobile sources. Growth factors are ratios which compare the amount of emission-producing activity expected in the projection year to that which occurred in the base year (1990). Thus, growth factors quantify the proportional increase or decrease that economic growth or decline is expected to have on emission levels from 1990 to the projection year. Because growth in emissions for all source categories cannot be directly determined, growth factors are derived using surrogate measures of growth which are indirect, quantifiable measures of activities that are expected to grow in a manner similar to emissions from the various source categories. For example, growth in gasoline tank truck loading and unloading is related to growth in vehicle miles traveled (VMT), since demand for gasoline determines the need for gasoline transport. Similarly, population growth serves as a good indicator of expected increases in emissions from residential fuel use.

Sources of data used to derive Delaware's growth factors include population statistics from *Population Projections, Version 1992.Q* Delaware Population Consortium, Dover, DE, January 1992; earnings and employment data by industry type from *BEA Regional Projections to 2040, Volumes I, II, and III*, U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Washington, D.C., U.S. Government Printing Office, October 1990; and local surveys conducted by the Air Quality Management Section of the Delaware Department of Natural Resources and Environmental Control (DNREC). The growth factors were derived according to *Procedures for Preparing Emissions Projections*, EPA-450/4-91-019, July 1991, (hereafter referred to as *Procedures/Projections*), and the *Guidance for Growth Factors, Projections, and Control Strategies for the 15 Percent Rate-of-Progress Plans*, EPA-452/R-93-002, March 1993, (hereafter referred to as the *Guidance for Growth/Projections/Strategies*), U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

For point sources, growth factors are developed for facility level Standard Industrial Classification (SIC) code categories. SIC codes are a series of number codes devised by the federal Office of Management and Budget to classify establishments according to the type of economic activity in which they are engaged. Point source emissions are grouped by two or four digit SIC code for purposes of applying growth factors. Growth factors for projecting electric utility NO<sub>x</sub> emissions are developed differently because the document *Procedures/Projections* prescribes a different methodology for projecting NO<sub>x</sub> emissions from electric utilities. This methodology yields projection year unit-level annual NO<sub>x</sub> emissions by fuel type. The ratio of the projection year and base year annual NO<sub>x</sub> emissions gives the projection year unit-level growth factor by fuel type. For stationary area and off-road mobile sources, growth factors are developed for source classification code (SCC) categories. Source classification codes are a series of number codes developed by EPA to define specific types of VOC or NO<sub>x</sub> emitting activities. Area source emissions are generally grouped by four digit SCC code for purposes of applying growth factors. The growth factors are used to develop the point, stationary area and off-road mobile source portions of the 1999 Current Control Projection Inventory. Growth factors are not applicable to the on-road mobile source category because on-road mobile source projections are determined through modeling.

## THE 1999 CURRENT CONTROL PROJECTION METHODOLOGY

### PROJECTION METHODOLOGY FOR POINT SOURCES

Point sources are projected according to the *Guidance for Growth/Projections/Strategies*. Although point source growth factors are developed based on broad SIC groupings, the projections for the point sources are accomplished on a process-by-process basis because point source VOC controls are generally applied at the process level. Point source emissions are projected using either 1990 actual emissions rates or 1990 allowable emissions rates depending on whether or not a source will be subject to new VOC controls by the projection year. Per a memo from John Seitz, Director of EPA's Office of Air Quality Planning and Standards, dated April 13, 1993, emissions projections for point sources must be evaluated at allowable emissions rates rather than 1990 actual emission rates for sources that will have new controls by the projection year. The memo also states that projections for sources whose 1990 regulatory limit will not be changed in the projection year can be based on 1990 actual emissions. Therefore, point source emissions are projected using the following two methods:

► Method 1

Emissions for point sources that will have new controls by the post-1996 milestone year are determined at allowable emissions rates. Allowable emissions are determined from *enforceable* (1990 regulatory or permit) emissions rates, *anticipated* operating rates, and *anticipated* operating schedules. The 1999 Current Control Projection Inventory emissions for point sources are determined by inserting the 1990 regulatory or permit conditions and 1990 operating data into the projection equations from Section 6.4 of the *Guidance for Growth/Projections/Strategies*. These projection equations use controlled emissions factors or process control efficiencies, process operating parameters, growth factors, and rule effectiveness factors to project emissions to the target year.

More specifically, for purposes of the 1999 Current Control Projection Inventory:

- Controlled Emissions Factors or Process Control Efficiencies are 1990 regulatory or permit limits expressed in mass of emissions per unit time or weight percent emissions reduction for each affected process in the 1990 Baseline Inventory.
- Process Operating Parameters are 1990 process throughput values, operating schedules, or emissions rates for each affected process in the 1990 Baseline Inventory.
- Growth Factors for point sources are developed for facility level Standard Industrial Classification Codes as previously discussed. Growth Factors for electric utility NO<sub>x</sub> emissions are developed for facility-level SCC type.
- Rule effectiveness is an adjustment to the emissions estimates of regulated sources to account for the fact that all sources are not in compliance with applicable air regulations 100 percent of the time. The rule effectiveness adjustment compensates for underestimates of emissions caused by

noncompliance with existing regulations, control equipment downtime, operating problems, and process upsets.

- Because the same projection equations are used to determine both the 1999 Current Control Projection Inventory and the 1999 Control Strategy Projection Inventory (discussed in Part III of this plan), sample calculations using the projection equations are presented in Part III of this plan.

► Method 2

Point source processes that will not have new controls by 1999 are projected by multiplying the appropriate growth factor for that process by the 1990 actual baseline emissions for that process.

## **PROJECTION METHODOLOGY FOR STATIONARY AREA AND OFF-ROAD MOBILE SOURCES**

The 1999 Current Control Projection Inventory for stationary area and off-road mobile sources is determined by multiplying the 1990 Baseline Inventory emissions for each emissions category by the appropriate growth factor.

## **PROJECTION METHODOLOGY FOR ON-ROAD MOBILE SOURCES**

On-road mobile source projections are determined using the EPA's MOBILE5a software. The on-road mobile source 1999 Current Control Projection Inventory is based on 1990 emissions factors generated by MOBILE5a and the 1999 projected vehicle-miles-traveled (VMT) on the 1990 Delaware roadway network. The projection inventories for 1999 are developed by Vanasse Hangen Brustlin, Inc. under contract with DelDOT, following similar procedures as were used in the preparation of the on-road mobile source emissions in Delaware's 1990 Base Year Inventory.

The 1999 Current Control Projection Inventory for on-road mobile sources is based on VMT projections made by the network-based travel-demand models for Kent and New Castle Counties. The 1990 and 1999 VMT projections calculated by the travel demand models for each functional class are used to derive a growth factor which was applied to the 1990 VMT estimates from the Highway Performance Monitoring System (HPMS) data. This methodology provides consistency with the 1990 Base Year Inventory methodology, since they are both based on the HPMS VMT. The 1990 motor vehicle emission factors used in the 1999 Current Control Projection Inventory are the same as the emission factors used in the 1990 Base Year Inventory. The 1990 and milestone year VMT projections calculated by the travel demand models for each functional class were used to derive a growth factor which was applied to the 1990 VMT estimates from the Highway Performance Monitoring System (HPMS) data. This methodology provides consistency with the 1990 Base Year Inventory methodology, since they are both based on the HPMS VMT.

### **CALCULATION OF TOTAL REQUIRED VOC EMISSIONS REDUCTION**

The total amount of VOC emissions reductions that Delaware must plan to achieve in order to meet the rate of progress requirement for the 1990-1999 period is the difference between the 1999 Current Control Projection Inventory and the 1999 Target Level of VOC emissions. In other words, these are the VOC emissions reductions that must be achieved between 1990 and 1999 to satisfy not only the 15% Plan requirements but also the 3 percent per year rate of progress requirements for the period 1996-1999. The NO<sub>x</sub> emissions reduction requirement for the 1990-1999 period is determined similarly. The required reductions are summarized in Table 13.

**TABLE 13**  
**REQUIRED EMISSIONS REDUCTIONS FOR MILESTONE YEAR 1999**  
**IN TONS PER PEAK OZONE SEASON DAY**

DESCRIPTION	VOC	NO <sub>x</sub>
Current Control Projection	159.738	184.059
Target Level	110.185	148.995
<b>Emissions Reductions Required for 1999</b>	<b>49.553</b>	<b>35.064</b>

## PART III

### 1999 CONTROL STRATEGY PROJECTION INVENTORY AND CONTROL MEASURES

#### THE 1999 CONTROL STRATEGY PROJECTION INVENTORY

The amounts of VOC and NO<sub>x</sub> emissions reductions that Delaware must plan to achieve in order to meet the 3 percent per year rate of progress requirement for the milestone year 1999 are already determined and presented in Table 13. These emissions reductions will be achieved through the implementation of national, regional and local control measures. Some of the control measures are already presented in the 15% Plan. In order to show that the reductions associated with these new control measures are adequate to meet the 3 percent per year reduction requirement for the milestone year 1999, the 1990 Baseline emissions are projected to milestone year 1999 including the effects of both growth and the new control measures, and the resulting inventory is compared to the 1999 Target Level of VOC and NO<sub>x</sub> emissions. **The inventory that results from projecting 1990 Baseline emissions to the milestone year 1999 including growth and new controls is called the 1999 Control Strategy Projection Inventory.** The 1999 control strategy projection inventory of VOC and NO<sub>x</sub> emissions for the total nonattainment area and by county are in Tables 14 and 15, respectively.

To show that the control measures will be adequate to meet the average 3 percent per year rate of progress requirement, the expected level of the 1999 Control Strategy Projection emissions must be equal to or less than the 1999 target level of emissions. The total 1999 Control Strategy Projection Inventory of VOC and NO<sub>x</sub> emissions respectively are 110.185 (Table 14) and 147.203 (Table 15) tons per peak ozone season day. The total 1999 Control Strategy Projection of VOC and NO<sub>x</sub> emissions values are less than or equal to the respective target levels 110.185 and 148.995 tons per day (Table 9). Therefore, the control measures that are included in the 1999 Control Strategy Projection are adequate to meet the 3 percent per year rate of progress requirement for the 1996-1999 period.

**TABLE 14**  
**SUMMARY OF 1999 CONTROL STRATEGY PROJECTION INVENTORY VOC**  
**EMISSIONS IN TONS PER PEAK OZONE SEASON DAY**

CATEGORY	KENT COUNTY	NEW CASTLE COUNTY	TOTAL NONATTAINMENT AREA
Point Sources	1.279	21.313	22.592
Stationary Area Sources	10.247	27.999	38.246
Off-Road Mobile Sources	3.436	15.871	19.307
On-Road Mobile Sources	7.550	22.490	30.040
<b>Total Emissions</b>	<b>22.512</b>	<b>87.673</b>	<b>110.185</b>

**TABLE 15**  
**SUMMARY OF 1999 CONTROL STRATEGY PROJECTION INVENTORY NO<sub>x</sub>**  
**EMISSIONS IN TONS PER PEAK OZONE SEASON DAY**

CATEGORY	KENT COUNTY	NEW CASTLE COUNTY	TOTAL NONATTAINMENT AREA
Point Sources	3.846	71.467	75.313
Stationary Area Sources	0.959	4.718	5.677
Off-Road Mobile Sources	8.266	19.167	27.433
On-Road Mobile Sources	10.270	28.510	38.780
<b>Total Emissions</b>	<b>23.341</b>	<b>123.862</b>	<b>147.203</b>

## THE 1999 CONTROL STRATEGY PROJECTION METHODOLOGY

### PROJECTION METHODOLOGY FOR POINT SOURCES

Point sources are projected on a process-by-process basis in accordance with the *Guidance for Growth/Projections/Strategies*. As explained in Part II of this summary, the method used to project point source emissions is dependent on whether or not a source will have new controls by the projection year. VOC and NO<sub>x</sub> emissions for point sources that will have new controls by 1999 are projected at allowable emissions rates using the same point source projection equations that are used to determine the 1999 Current Control Projection Inventory. However, the projection data used for the 1999 Control Strategy Projection Inventory differs from the 1999 Current Control Projection Inventory. The difference is that the processes that will have new controls by 1999 will have updated controlled emissions factors, process control efficiencies, emissions rates, and rule effectiveness values instead of 1990 controls. VOC and NO<sub>x</sub> emissions for point sources that will not have new controls by 1999 are projected by multiplying the 1990 actual baseline emissions by the appropriate growth factor.

The following is an example of 1999 Control Strategy Projection calculation for a point source process that will have new controls by 1999:

#### Example Point Source Calculation

The Delaware Regulations Governing Solid Waste have been revised since 1990 to include requirements for installation of gas control systems at all sanitary landfills. Control efficiencies for each affected landfill are determined based on design data for the proposed gas control systems. For the Cherry Island facility located in New Castle County, a control device efficiency (flare efficiency) of 98% and a capture efficiency of 51.49% are used to project the VOC emissions. The overall control efficiency for the Cherry Island landfill is:

$$0.98 \times 0.5149 = 0.5046 = 50.46\%$$

Using the emissions projection equation:

$$EMIS_{py} = CRTPOL \times \frac{1 - \frac{CE_{py}}{100} \times \frac{RE_{py}}{100}}{1 - \frac{CEQEFF}{100} \times \frac{RULEFF}{100}} \times GF_{py},$$

where:

- $EMIS_{py}$  = Projection Year Emissions (Tons Per Peak Ozone Season Day)
- $CRTPOL$  = 1990 Base Year Ozone Season Actual Emissions  
(Tons Per Peak Ozone Season Day)
- $CE_{py}$  = Projection Year Control Efficiency (Percent)
- $RE_{py}$  = Projection Year Rule Effectiveness (Percent)
- $CEQEFF$  = 1990 Base Year Control Efficiency (Percent)
- $RULEFF$  = 1990 Base Year Rule Effectiveness (Percent)
- $GF_{py}$  = 1999 Growth Factor (Dimensionless)

the 1999 projected VOC emissions value for the Cherry Island landfill with the addition of new controls is:

$$\begin{aligned} EMIS_{py} &= 0.268 \times \frac{1 - \frac{50.46}{100} \times \frac{80}{100}}{1 - \frac{0}{100} \times \frac{0}{100}} \times 1.07 \\ &= 0.171 \text{ tons VOC/day} \end{aligned}$$

## PROJECTION METHODOLOGY FOR STATIONARY AREA AND OFF-ROAD MOBILE SOURCES

Stationary area and off-road mobile sources that **will not** be subject to new controls by 1999 are projected by multiplying the 1990 Baseline Emissions for the category by the appropriate growth factor. For stationary area and off-road mobile sources that **will** be subject to new controls by 1999, the 1999 Control Strategy Projections are determined in a manner similar to the point source 1999 Control Strategy Projections, using projection equations from the *Guidance for Growth/Projections/Strategies*. The main difference between the point source projections and the stationary area and off-road mobile source projections is that point source emissions are projected on a process-by-process basis as described above, while stationary area and off-road mobile source emissions are projected on a category-wide basis. Therefore, the 1999 Control Strategy Projection Inventory for stationary area and off-road mobile sources is determined using category-wide activity level data versus the process operating data that is used for point source projections.

The stationary area and off-road mobile source projection data reflects the 1999 controls and rule effectiveness values. A rule penetration value is also factored into the emissions projection. Rule penetration factors are used in conjunction with rule effectiveness to adjust regulated stationary area

source emissions estimates. Rule penetration is the portion of an area source category that is affected by a regulation. If a regulation applies to only a certain percentage of sources within a source category, a rule penetration factor is applied to ensure that the rule effectiveness adjustment affects only the emissions values for those regulated sources, and not the emissions values for the unregulated sources in the category.

The following is an example 1999 Control Strategy Projection calculation for a stationary area source category that will have new controls by 1999:

### Example Stationary Area Source Calculation

Section 34 of Delaware Air Regulation 24 prohibits the manufacture, mixing, storage, use, and application of cutback asphalt during the ozone season. 1999 projected VOC emissions from cutback asphalt with new controls for Kent County are determined using the area source projection equation:

$$EMIS_{py} = ACTLEV \times EMF_{py} \times GF_{py} \times \left[ 1 - \frac{CE_{py}}{100} \times \frac{RE_{py}}{100} \times \frac{RP_{py}}{100} \right]$$

where:

$EMIS_{py}$  = Projection Year Emissions (Tons/Peak Ozone Season Day)

$ACTLEV$  = 1990 Baseline Activity Level

(Production Units/Peak Ozone Season Day)

$EMF_{py}$  = Projection Year Emissions Factor

(Mass of Pollutant/Production Unit)

$GF_{py}$  = Projection Year Growth Factor

$CE_{py}$  = Projection Year Control Efficiency (Percent)

$RE_{py}$  = Projection Year Rule Effectiveness (Percent)

$RP_{py}$  = Projection Year Rule Penetration (Percent)

The control efficiency and rule penetration are both determined from Section 34 of Regulation 12 to be 100%. The projected VOC emissions are:

$$\begin{aligned} EMIS_{py} &= 0.173 \times 420 \times 0.87 \times \left[ 1 - \frac{100}{100} \times \frac{80}{100} \times \frac{100}{100} \right] \times \frac{1}{2000} \text{ tons VOC/day} \\ &= 0.006 \text{ tons VOC/day} \end{aligned}$$

### PROJECTION METHODOLOGY FOR ON-ROAD MOBILE SOURCES

The on-road mobile source 1999 Control Strategy Projection Inventory is determined from 1999 emissions factors generated by MOBILE5a and the projected vehicle-miles-traveled (VMT) on the 1996 Delaware roadway network. The 1999 VMT projections are determined using the network-based Travel Demand Model for Kent and New Castle Counties. The 1990 and 1999 VMT projections, calculated by the travel demand models for each functional class, are used to derive a

growth factor which was applied to the 1990 VMT estimates from the Highway Performance Monitoring System (HPMS) data. This methodology provides consistency with the 1990 Base Year Inventory methodology, since they are both based on HPMS VMT. The on-road mobile source projection inventory is developed by Vanasse Hangen Brustlin, Inc. under contract with DelDOT.

## **CONTROL MEASURES**

The control measures that Delaware plans to implement in order to meet the average 3 percent per year rate of progress for the milestone year 1999 are listed in Tables 16. The VOC and NO<sub>x</sub> emissions reductions from each control measure are listed in Table 16. The VOC and NO<sub>x</sub> emissions reductions for the nonattainment area are 49.553 and 36.856 tons per peak ozone season day, respectively. The VOC and NO<sub>x</sub> reductions that are required by Delaware in order to meet the average 3 percent rate of progress requirement are 49.553 and 35.064 tons per peak ozone season day, respectively (determined in Part II of this summary). Therefore, the control measures listed in Tables 16 are adequate to meet the 3 percent per rate of progress requirement for the milestone year 1999.

**TABLE 16**  
**CONTROL MEASURES, EXPECTED VOC AND NO<sub>x</sub> EMISSIONS REDUCTIONS**  
**IN TONS PER PEAK OZONE SEASON DAY FOR THE 1999 RPP**

CONTROL MEASURE	CREDITABLE/ NONCREDITABLE	IMPLEMENTATION DATE	VOC REDUCTIONS	NO <sub>x</sub> REDUCTIONS
<b>POINT SOURCE CONTROLS</b>				
RACT IN KENT COUNTY				
▸ Solvent Metal Cleaning	Creditable	May 31, 1995	0.568	N/A
▸ Surface Coating of Metal Furniture	Creditable	May 31, 1995	0.080	N/A
▸ Leaks from Synthetic Organic Chemical, Polymer, and Resin	Creditable	May 31, 1995	0.004	N/A
DELAWARE RACT REGULATIONS				
▸ Bulk Gasoline Marine Tank Vessel Loading Facilities	Creditable	December 31, 1995	1.896	N/A
▸ SOCM I Reactor Processes and Distillation Operations	Creditable	April 1, 1996	0.025	N/A
▸ Batch Processing Operations	Creditable	April 1, 1996	0.418	N/A
▸ Offset Lithography	Creditable	April 1, 1996	0.081	N/A
▸ Aerospace Coatings	Creditable	April 1, 1996	0.008	N/A
▸ Industrial Cleaning Solvents	Creditable	November 1, 1996	0.509	N/A
▸ Non-CTG RACT	Creditable	May 31, 1995	0.368	N/A
▸ Delaware NO <sub>x</sub> RACT	Creditable	May 31, 1995	0.000	3.268
REGIONAL CONTROLS				
▸ Regional NO <sub>x</sub> MOU	Creditable	May 1, 1999	0.000	24.650
FEDERAL RULES				
▸ Benzene Waste Rule	Creditable	Spring 1995	1.733	N/A
OTHER DELAWARE REGULATIONS				
▸ Sanitary Landfills	Creditable	October 9, 1993	0.251	N/A
▸ Irreversible Process Changes	Creditable	January 1, 1996	1.928	N/A
<b>Total Point Source Reductions</b>			<b>7.869</b>	<b>27.918</b>

**TABLE 16 CONTINUED**  
**CONTROL MEASURES, EXPECTED VOC AND NO<sub>x</sub> EMISSIONS REDUCTIONS**  
**IN TONS PER PEAK OZONE SEASON DAY FOR THE 1999 RPP**

CONTROL MEASURE	CREDITABLE/ NONCREDITABLE	IMPLEMENTATION DATE	VOC REDUCTIONS	NO <sub>x</sub> REDUCTIONS
<b>STATIONARY AREA SOURCE CONTROLS</b>				
RACT "CATCH-UPS" IN KENT COUNTY				
▸ Solvent Metal Cleaning	Creditable	May 31, 1995	0.133	N/A
▸ Cutback Asphalt	Creditable	May 31, 1995	0.026	N/A
DELAWARE RACT REGULATIONS				
▸ Stage I Vapor Recovery- Gasoline Dispensing Facilities	Creditable	November 15, 1994	0.645	N/A
▸ Emulsified Asphalt	Creditable	May 1995	0.053	N/A
▸ Motor Vehicle Refinishing	Creditable	April 1, 1996	1.289	N/A
▸ Offset Lithography	Creditable	April 1, 1996	0.077	N/A
▸ Aerospace Coatings	Creditable	April 1, 1996	0.032	N/A
▸ Stage II Vapor Recovery Systems	Creditable	November 15, 1994	1.780	N/A
OTHER DELAWARE REGULATIONS				
▸ Open Burning	Creditable	February 8, 1995	7.674	1.527
<b>Total Stationary Area Source Reductions</b>			<b>11.709</b>	<b>1.527</b>
<b>OFF-ROAD MOBILE SOURCE CONTROLS</b>				
▸ Reformulated Gasoline	Creditable	January 1, 1995	0.522	N/A
▸ New Emissions Standards for Spark Ignition Engines	Creditable	EPA--Court Ordered	1.781	-0.082
▸ New Emissions Standards for Compression Ignition Engines	Creditable	EPA--Court Ordered	0.000	1.124
▸ New Emissions Standards for Marine Engines	Creditable	EPA--Court Ordered	0.012	-0.001
<b>Total Off-Road Source Reductions</b>			<b>2.315</b>	<b>1.041</b>
<b>ON-ROAD MOBILE SOURCE CONTROLS</b>				
▸ FMVCP and RVP	Noncreditable	Pre-1990	18.120	2.140
▸ Tier I Vehicle Emissions Standards	Creditable	Model Year 1994	1.420	3.410
▸ a. Basic I/M in Kent County	Creditable	January 1, 1991	1.400	0.230
▸ b. ATP and Pressure Test in Kent County	Creditable	January 1, 1995		
▸ ATP and Pressure Test in New Castle County	Creditable	January 1, 1995	4.240	0.760
▸ Reformulated Fuel	Creditable	January 1, 1995	2.480	-0.170
▸ LEV Program	Discredited	November 1999	(0.050) <sup>7</sup>	(0.100)
<b>Total On-Road Mobile Source Reductions</b>			<b>27.660</b>	<b>6.370</b>
<b>TOTAL EMISSIONS REDUCTIONS</b>			<b>49.553</b>	<b>36.856</b>

<sup>7</sup>Numbers in brackets do not count in the totals.

**TABLE 17**  
**EXPECTED VOC AND NO<sub>x</sub> EMISSIONS REDUCTIONS BY COUNTY IN TONS PER PEAK OZONE SEASON DAY**

CONTROL MEASURE	VOC REDUCTIONS		NO <sub>x</sub> REDUCTIONS	
	KENT COUNTY	NEW CASTLE COUNTY	KENT COUNTY	NEW CASTLE COUNTY
<b>POINT SOURCE CONTROLS</b>				
RACT IN KENT COUNTY				
▸ Solvent Metal Cleaning	0.568	N/A	N/A	N/A
▸ Surface Coating of Metal Furniture	0.080	N/A	N/A	N/A
▸ Leaks from Synthetic Organic Chemical, Polymer, and Resin Manufacturing	0.004	N/A	N/A	N/A
DELAWARE RACT REGULATIONS				
▸ Bulk Gasoline Marine Tank Vessel Loading Facilities	N/A	1.896	N/A	N/A
▸ SOCM I Reactor Processes and Distillation Operations	N/A	0.025	N/A	N/A
▸ Batch Processing Operations	0.380	0.038	N/A	N/A
▸ Offset Lithography	N/A	0.081	N/A	N/A
▸ Aerospace Coatings	0.004	0.004	N/A	N/A
▸ Industrial Cleaning Solvents	N/A	0.509	N/A	N/A
▸ Non-CTG RACT	0.153	0.215	N/A	N/A
▸ Delaware NO <sub>x</sub> RACT	0.000	0.000	1.051	2.217
REGIONAL CONTROLS				
▸ Regional NO <sub>x</sub> MOU	0.000	0.000	1.641	23.009
FEDERAL RULES				
▸ Benzene Waste Rule	N/A	1.733	N/A	N/A
OTHER DELAWARE REGULATIONS				
▸ Sanitary Landfills	0.064	0.187	N/A	N/A
▸ Irreversible Process Changes	0.735	1.193	N/A	N/A
<b>Total Point Source Reductions</b>	<b>1.988</b>	<b>5.881</b>	<b>2.692</b>	<b>25.226</b>

**TABLE 17 CONTINUED**  
**EXPECTED VOC AND NO<sub>x</sub> EMISSIONS REDUCTIONS BY COUNTY IN TONS PER PEAK OZONE SEASON DAY**

CONTROL MEASURE	VOC REDUCTIONS		NO <sub>x</sub> REDUCTIONS	
	KENT COUNTY	NEW CASTLE COUNTY	KENT COUNTY	NEW CASTLE COUNTY
<b>STATIONARY AREA SOURCE CONTROLS</b>				
RACT "CATCH-UPS" IN KENT COUNTY				
▸ Solvent Metal Cleaning	0.133	N/A	N/A	N/A
▸ Cutback Asphalt	0.026	N/A	N/A	N/A
DELAWARE RACT REGULATIONS				
▸ Stage I Vapor Recovery-Gasoline Dispensing Facilities	0.488	0.157	N/A	N/A
▸ Emulsified Asphalt	0.026	0.027	N/A	N/A
▸ Motor Vehicle Refinishing	0.259	1.030	N/A	N/A
▸ Offset Lithography	0.076	0.001	N/A	N/A
▸ Aerospace Coatings	N/A	0.032	N/A	N/A
▸ Stage II Vapor Recovery Systems	0.423	1.357	N/A	N/A
OTHER DELAWARE REGULATIONS				
▸ Open Burning	1.795	5.879	0.352	1.175
<b>Total Stationary Area Reductions</b>	<b>3.226</b>	<b>8.483</b>	<b>0.352</b>	<b>1.175</b>
<b>OFF-ROAD MOBILE SOURCE CONTROLS</b>				
▸ Reformulated Gasoline	0.068	0.454	N/A	N/A
▸ New Emissions Standards for Spark Ignition Engines	0.419	1.362	-0.015	-0.067
▸ New Emissions Standards for Compression Ignition Engines	0.000	0.000	0.304	0.820
▸ New Emissions Standards for Marine Engines	0.000	0.012	0.000	-0.001
<b>Total Off-Road Source Reductions</b>	<b>0.487</b>	<b>1.828</b>	<b>0.289</b>	<b>0.752</b>
<b>ON-ROAD MOBILE SOURCE CONTROLS</b>				
▸ FMVCP and RVP	5.670	12.450	1.380	0.760
▸ Tier I Vehicle Emissions Standards	0.260	1.160	0.710	2.700
▸ a. Basic I/M in Kent County	1.400	N/A	0.230	N/A
▸ b. ATP and Pressure Test in Kent County				
▸ ATP and Pressure Test in New Castle County	N/A	4.240	N/A	0.760
▸ Reformulated Fuel	0.580	1.900	-0.020	-0.150
▸ LEV Program	(0.010)	(0.040)	(0.010)	(0.090)
<b>Total On-Road Mobile Reductions</b>	<b>7.910</b>	<b>19.750</b>	<b>2.300</b>	<b>4.070</b>
<b>TOTAL EMISSIONS REDUCTIONS</b>	<b>13.611</b>	<b>35.942</b>	<b>5.633</b>	<b>31.223</b>

Total VOC Reductions = 49.553 Tons/Day  
(Includes Noncreditable FMVCP/RVP Reductions)

Creditable VOC Reductions = 31.433 Tons/Day  
(Excludes Noncreditable FMVCP/RVP Reductions)

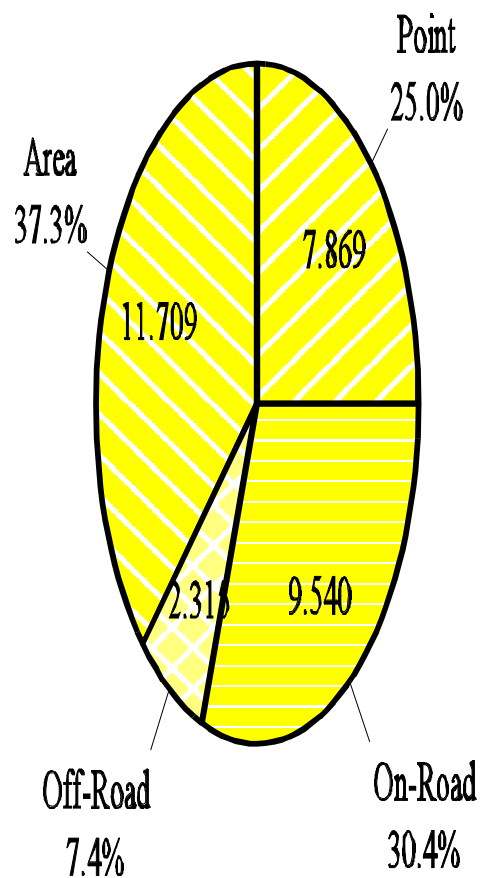
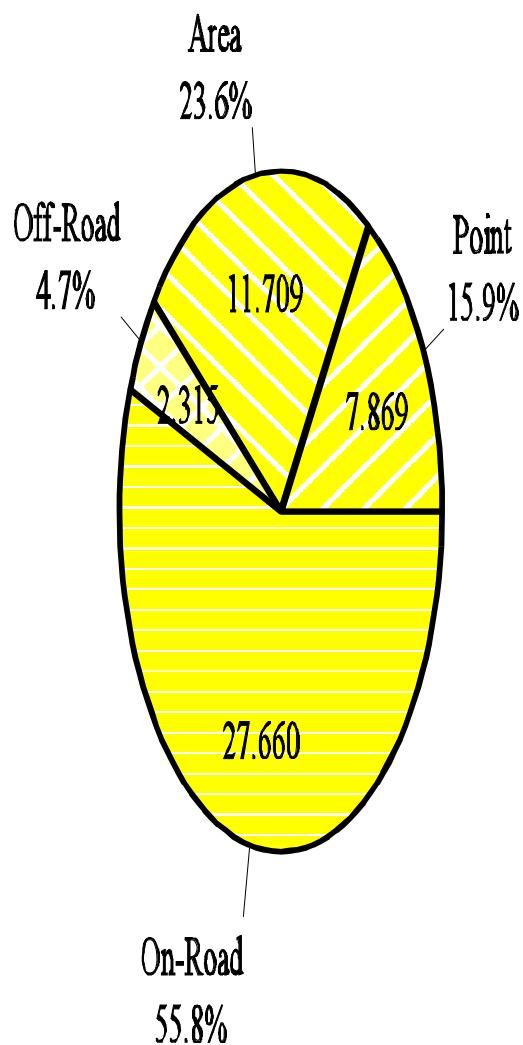


Figure 8. VOC Emissions Reductions by Source Category for 1999 RPP

Total NO<sub>x</sub> Reductions = 36.856 Tons/Day  
(Includes Noncreditable FMVCP/RVP Reductions)

Creditable NO<sub>x</sub> Reductions = 34.716 Tons/Day  
(Excludes Noncreditable FMVCP/RVP Reductions)

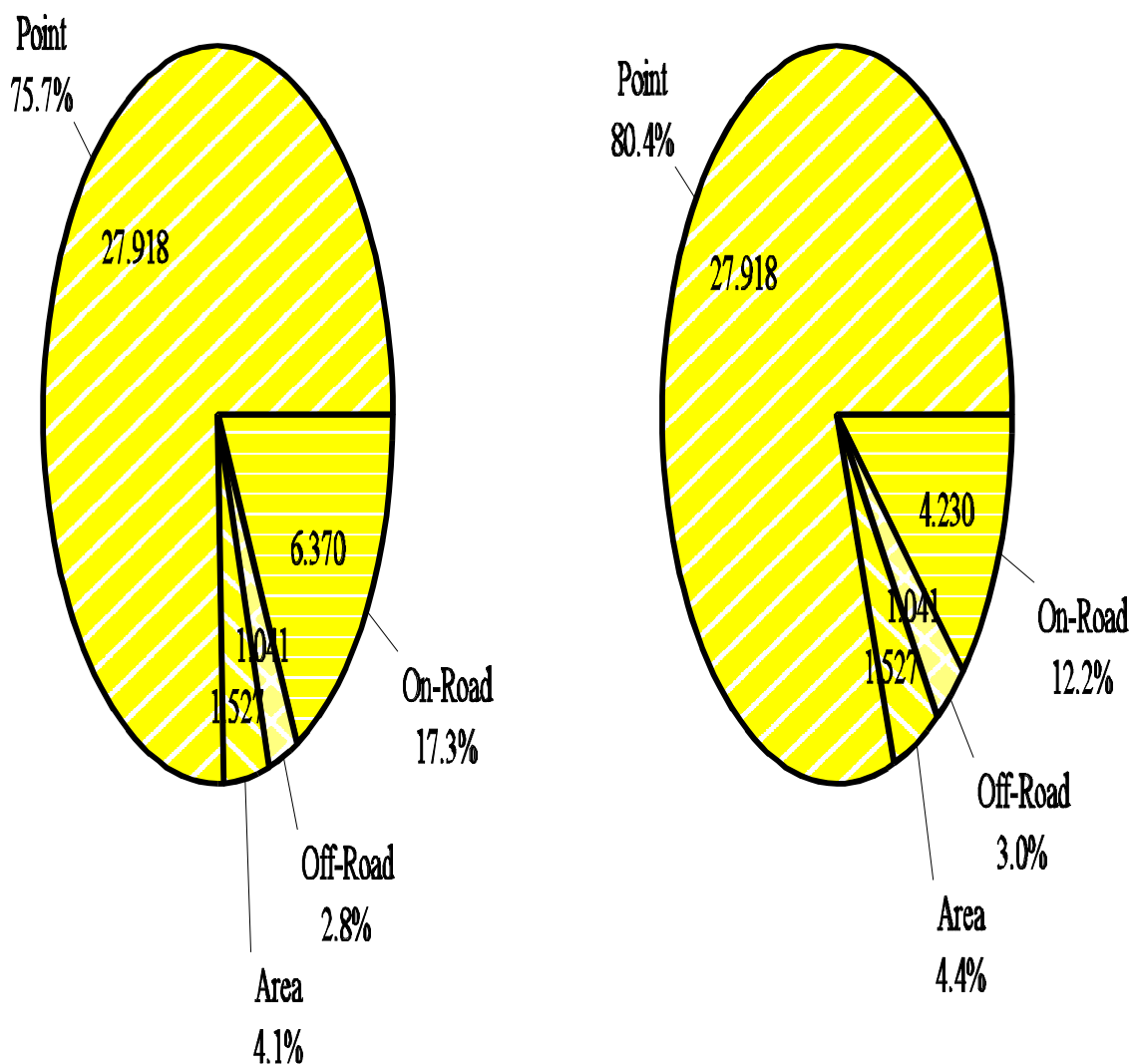


Figure 9. NO<sub>x</sub> Emissions Reductions by Source Category for 1999 RPP

